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(71) Applicant (for all designated States except US): TECFLEX LIMITED [GB/GB]; Unit 2A, Fieldway, Northfield Industrial Estate, Rotherham S60 1QG (GB).

(72) Inventors; and

(75) Inventors/Applicants (for US only) : CARR, Michael, David [GB/GB]; 133 Trap Lane, Sheffield S11 7RF (GB). GOVIER, Roland, Day [GB/GB]; 6 Devonshire Road, Sheffield S17 3NT (GB).

(74) Agent: HULSE & CO; Cavendish Buildings, West Street, Sheffield S1 1ZZ (GB).

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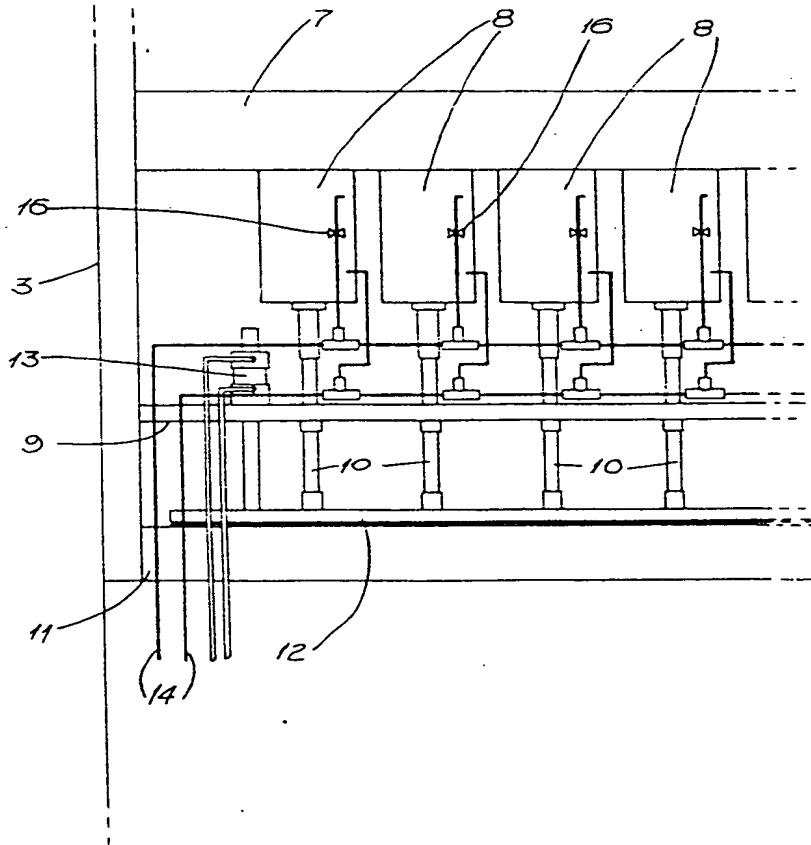
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(54) Title: PUNCHES

(57) Abstract

The invention relates to punch assemblies (8) and is particularly concerned with the punching of holes in flexible photopolymer sheeting, as is used extensively in the printing industry. The nature of flexible photopolymer sheeting is such as to make the creation of holes particularly difficult, and hitherto the only effective technique that has been available is drilling the holes in the sheet. The object of the invention is to provide an improved means of providing holes in flexible photopolymer sheeting which objective is met by a punch assembly (8) comprising a hollow tubular punch member (10) which, at its operative end is correspondingly inwardly contoured at diametrically opposite sides, and a support plate (11) or die, the punch (10) being mounted above the support plate (11) for rapid axial reciprocal movement towards and away from the support plate (11) and there being a corresponding hole in the support plate for the passage of the punch (10).



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**PUNCHES**

This invention relates to punches and to a punch assembly.

In the field of plastics films, foils and sheeting at large, there are numerous applications where the films, foils and sheets need to be perforated for particular purposes. This has led to the provision of various types of perforating or piercing tools such as for example as is shown in British Patent 1577104, where a piercing member with a heavily serrated cutting edge is provided to be driven through a thermoplastics foil, with an ejector means within the piercing member to discard scrap foil from within the piercing member. In common with the majority of perforating and piercing operations British 1577104 is concerned with the creation of a perforation and is not concerned with the accuracy with which the perforation is created. This is evident from the character of the cutting edge of the piercing member and that the foil is merely held taught below it.

Flexible photopolymer sheeting as is used extensively in the printing industry, is known to comprise a hard plastics cover sheet, an acetate backing sheet with a soft photopolymer filler between the sheets. To facilitate the accurate location of such sheeting on a printing roll, it is known to provide a registration bar in association with the print roll, and which bears registration pins adjustable as to their position on the bar, and to provide corresponding holes in the photopolymer sheeting. Thus, the photopolymer sheeting is first located by its holes on the appropriate registration

pins and the free end of the sheeting wrapped onto the roll, following which the sheeting is released from the registration bar and wrapping of the sheeting on to the roll completed.

Flexible polymer sheeting as discussed above, has its especial difficulties in providing accurately formed holes, and hitherto, the only effective method of providing the required holes in photopolymer sheeting has been by drilling, and as more than one hole is inevitably needed, individual hole drilling is not practical, leading to the provision of a bank of drills all simultaneously rotated even when a particular drill is not required to drill a hole.

It is the objective of the present invention to provide a punch and a punch assembly to form holes in photopolymer sheeting.

According to the present invention, a punch assembly for flexible photopolymer material comprises a hollow tubular punch member which, at its operative end is correspondingly inwardly contoured at diametrically opposite sides, and a support plate or die, the punch being mounted above the support plate for axial reciprocal movement towards and away from the support plate and there being a corresponding hole in the support plate for the passage of the punch. Preferably, an ejector pin is provided within and mounted for reciprocal movement with respect to the punch.

Thus, the punch is provided with two diametrically opposite protruding cutting edges and which facilitate to a considerable degree the passage of the punch through materials such as flexible photopolymer sheeting and with flexible

photopolymer sheeting located on the support plate below the punch, a rapid movement of the punch towards the sheeting allows the punch to pass cleanly through the sheeting to punch a hole therein, and with the punch extending through the hole in the support plate, the ejector pin is activated to remove the plug of the photopolymer sheeting from within the punch and deposit into a suitable receptacle below the support plate. Further preferably, a clamping means is provided to hold the flexible photopolymer material during movement of the punch.

For economic and rapid activation of both the punch and the ejector pin, pneumatics can be employed. Thus, the punch can be secured to a piston within a cylinder, and emerge from the cylinder, and the selective application of compressed air to one side or the other of the piston causes a rapid forward and return stroke of the punch. The piston for the punch can itself be cylindrical, and within which can be located a second piston attached to which is the ejector pin that extends through the end walls of the piston and down through the punch, selective application of compressed air to one side or the other of the second piston causing a rapid forward and return stroke of the ejector pin. Equally, the clamping means can be pneumatically operated.

With a number of such punch assemblies located in line and connected to a common source of compressed air by a common activating valve all such punches can be activated simultaneously. However simple additional valve means can be provided between each punch assembly and the source of

compressed air to isolate any one or more punch assemblies and when only those punches to provide the required number of holes at their required spacing are activated by the common activating valve.

One embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view of a machine embodying the invention;

Figure 2 is a schematic front elevation of a part of Figure 1 and to a larger scale showing the punch assemblies of Figure 1; and

Figure 3 is a sectional side elevation of a punch assembly according to the invention.

In Figure 1, equipment including punch assemblies of the invention comprises a cabinet 1 supporting a flat bed 2 and having two upright support pillars 3, one to either side of the cabinet. Between the support pillars 3, a housing 4 is provided containing the punch assemblies and which are described in greater below.

Within the cabinet 1 is a compressor and required electrical control equipment (not shown), and to the front of the cabinet two switches 5 and 6 are provided to be activated by the foot of the operative.

As is shown schematically and in more detail in Figure 2, within the housing 4 is a first transverse support member 7 extending between the pillars 3 on which are located a number of punch assemblies 8. Below the punch assemblies 8 and also

extending between the pillars 3 is a guide bar 9 having guide holes for the punches 10 of the punch assemblies, and also extending between the pillars 3 is a die bar 11 having holes in register with the punches of the punch assemblies, and in which the punches are a close sliding fit. Between the guide bar 9 and the die bar 11, is a movable clamping bar 12 activated by a pneumatic cylinder 13 to each end of the bar.

As is illustrated schematically, the punch assemblies 8 are each connected to a common source of compressed air by pneumatic air lines 14 and 15 for effecting the drive and return strokes of the punch assembly as will be described in greater detail below, and there being a shut-off valve 16 in the air line for the drive stroke of each punch assembly to allow for the selective activation of the punch assemblies.

As is shown by Figure 3, each punch assembly has a support member 17 to enable the punch assembly to be secured to the support bar 7 and which supports a cylinder 18 within which is a piston 19 to which the punch 10 is attached, there being air passageways 21, 22 through the cylinder to enable compressed air to be provided selectively above and below the piston and to effect the drive and return stroke of the punch 10. The piston 19 serves additionally as a cylinder for a piston 23 of an ejector pin 24 extending through the punch 19. To enable a drive stroke to be effected to the ejector pin, the upper end of the piston 19 has a cylindrical extension 25 with an outer end 26 of reduced diameter, extending into a counterbore 27 in a top end cap 28 to the cylinder 18. Thus, during a drive stroke, compressed air is admitted to the

cylinder 18 through the inlet 21, and at the point that the cylindrical extension 25 has been brought clear of its sealed penetration of the counterbore 27, compressed air is then admitted down the cylindrical extension to act on the piston 23 and to generate the drive stroke of the ejector pin 24. To enable the punch to cut cleanly through the polymer sheeting, the cutting end of the punch is provided with a contoured profile 25 and to be correspondingly inwardly contoured at diametrically opposite sides.

Thus, at the onset of operations, a flexible photopolymer sheeting is placed on the bed 2 and positioned on the bed 2 such that one edge extends to an appropriate degree beyond the line of the punch assemblies 8 and is so oriented that the sheeting is correctly located in relation to the plane of the punch assemblies. Once so positioned, the switch 5 is activated to admit pressure air to the cylinder 13 and to cause the clamp plate to clamp the polymer sheeting to the die bar 11. Once clamped, the switch 6 is activated to admit pressure air to the cylinders 18 to effect a drive stroke of the punches 10, with either all of the punches 10 simultaneously activated, or dependent upon the pattern of holes to be punched in the photopolymer sheeting, a number of the isolating switches 16 activated to hold required punch assemblies 8 inactive and whereby to punch a required pattern of holes in the photopolymer sheeting, followed immediately by the drive strokes to the ejector pins, to deposit the slug of photopolymer sheeting from within the punch into a suitable receptacle located within the cabinet 1. After punching, the

switches 5 and 6 are de-activated to cause the return of the punches and the return of the clamping bar. By holding the photopolymer sheeting firmly against the die bar and which has holes through which the punches are a close sliding fit, the co-operation between the die bar and the contoured cutting edge of the punch and the rapidity of movement of the punch is such that holes are punched in the photopolymer sheeting of the accuracy that is demanded by the subsequent use of the photopolymer sheeting and their location on registration pins in printing equipment.

## CLAIMS

1. A punch assembly for flexible photopolymer material characterised by a hollow tubular punch member which, at its operative end is correspondingly inwardly contoured at diametrically opposite sides, and a support plate or die, the punch being mounted above the support plate for axial reciprocal movement towards and away from the support plate and there being a corresponding hole in the support plate for the passage of the punch.

2. A punch assembly as in Claim 1, characterised in that an ejector pin is provided within and mounted for reciprocal movement with respect to the punch.

3. A punch assembly as in Claim 1 or Claim 2, characterised in that a clamping means is provided to hold the flexible photopolymer material during movement of the punch.

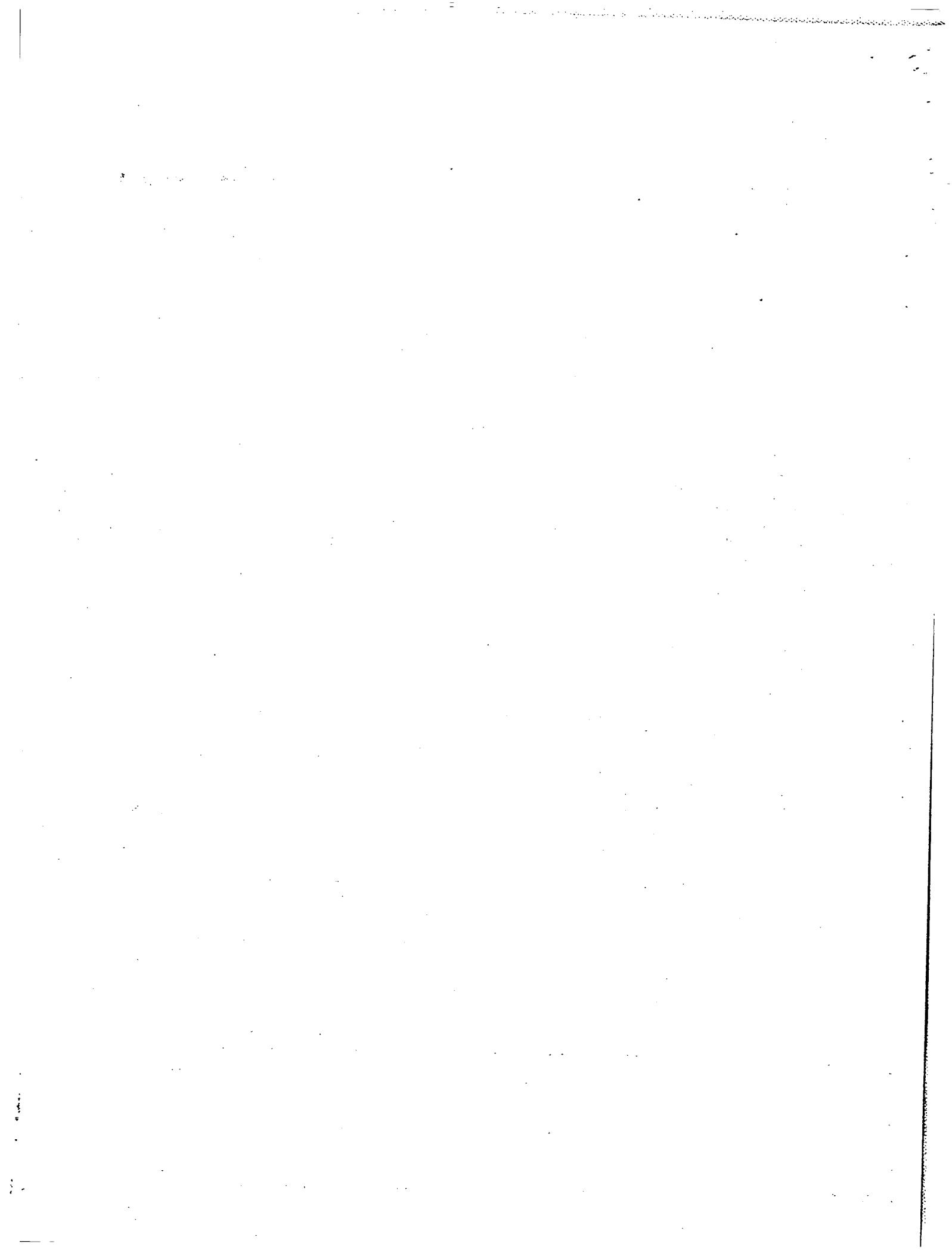
4. A punch assembly as in any of Claims 1 to 3, characterised in that the punch and the ejector pin are pneumatically operated.

5. A punch assembly as in Claim 3 or Claim 4, characterised in that the clamping means is pneumatically operated.

6. A punch assembly as in any of Claims 1 to 5, characterised in that a number of punch assemblies are provided connected to a common source of compressed air by a common activating valve.

7. A punch assembly as in Claim 6, characterised in that each individual punch assembly has its own isolating valve.

8. A punch assembly for flexible photopolymer sheeting, substantially as hereinbefore described with reference to the accompanying drawings.



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 90/00515

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)<sup>6</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B26F1/02 ; B26F1/04 ; B26D7/18

## II. FIELDS SEARCHED

Minimum Documentation Searched<sup>7</sup>

Classification System	Classification Symbols
Int.Cl. 5	B26F ; B26D

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched<sup>8</sup>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup>

Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y	US,A,4653369 (DUNSIRN) 31 March 1987 see column 1, lines 12 - 40 see column 2, line 15 see column 2, lines 36 - 37 see column 2, lines 46 - 56 see column 5, line 60 - column 6, line 16; figures 1-4 ---	1, 3, 5-8
Y	US,A,3320843 (SCHOTT) 23 May 1967 see column 1, lines 35 - 36 see column 2, lines 7 - 28; figures 1, 4-4b ---	1, 8
Y	US,A,4041815 (DAVIS ET AL) 16 August 1977 see column 4, line 44 - column 5, line 25 see column 7, lines 29 - 38; figure 2 ---	3, 5-7
A	US,A,3580120 (ADAMS ET AL) 25 May 1971 see the whole document ---	1, 2, 4, 6 -/-

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## IV. CERTIFICATION

Date of the Actual Completion of the International Search

27 JUNE 1990

Date of Mailing of this International Search Report

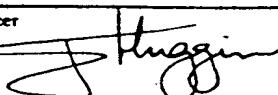
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## III. DOCUMENTS CONSIDERED TO BE RELEVANT

(CONTINUED FROM THE SECOND SHEET)

Category	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,4065990 (EDHLUND) 03 January 1978 see column 1, lines 5 - 7 see column 1, line 60 - column 2, line 2 see column 3, lines 31 - 43 see column 3, line 53 - column 4, line 3 see column 4, line 39 - column 5, line 8; figures 1-3	1, 3
A	US,A,4195541 (WIDNER ET AL) 01 April 1980 see the whole document	1
A	GB,A,1577104 (FELIX STIEGLER MASCHINENFABRIK) 15 October 1980 see the whole document (cited in the application)	2
A	US,A,3501987 (SCHNEIDER) 24 March 1970 see column 1, lines 28 - 31 see column 2, lines 1 - 12; figures 1, 2	4
A	US,A,3311297 (WILLIAMSON) 28 March 1967 see figures 2-4	7
A	FR,A,2224273 (RAVEL) 31 October 1974	
A	GB,A,1369190 (SCHUMACHER) 02 October 1974	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
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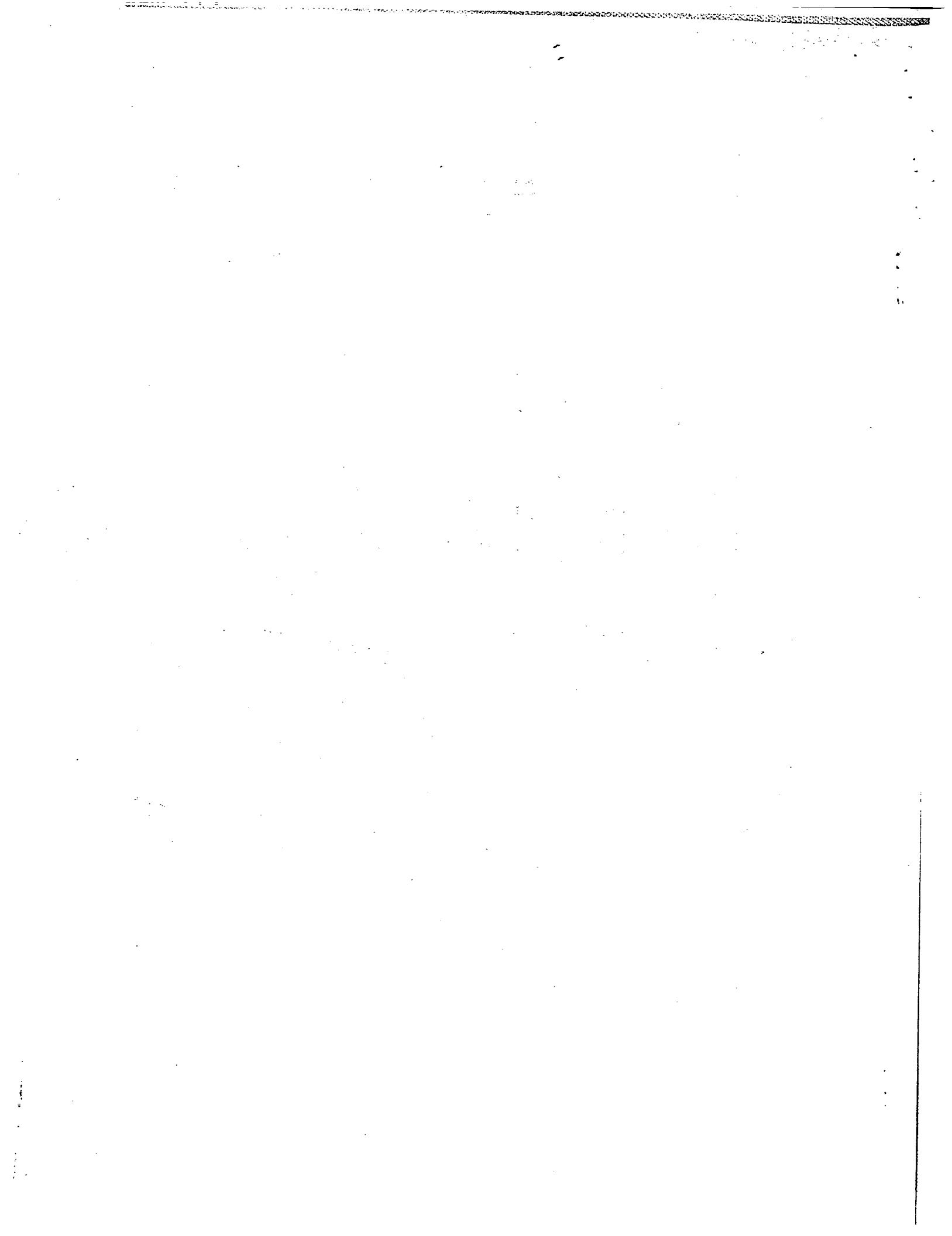
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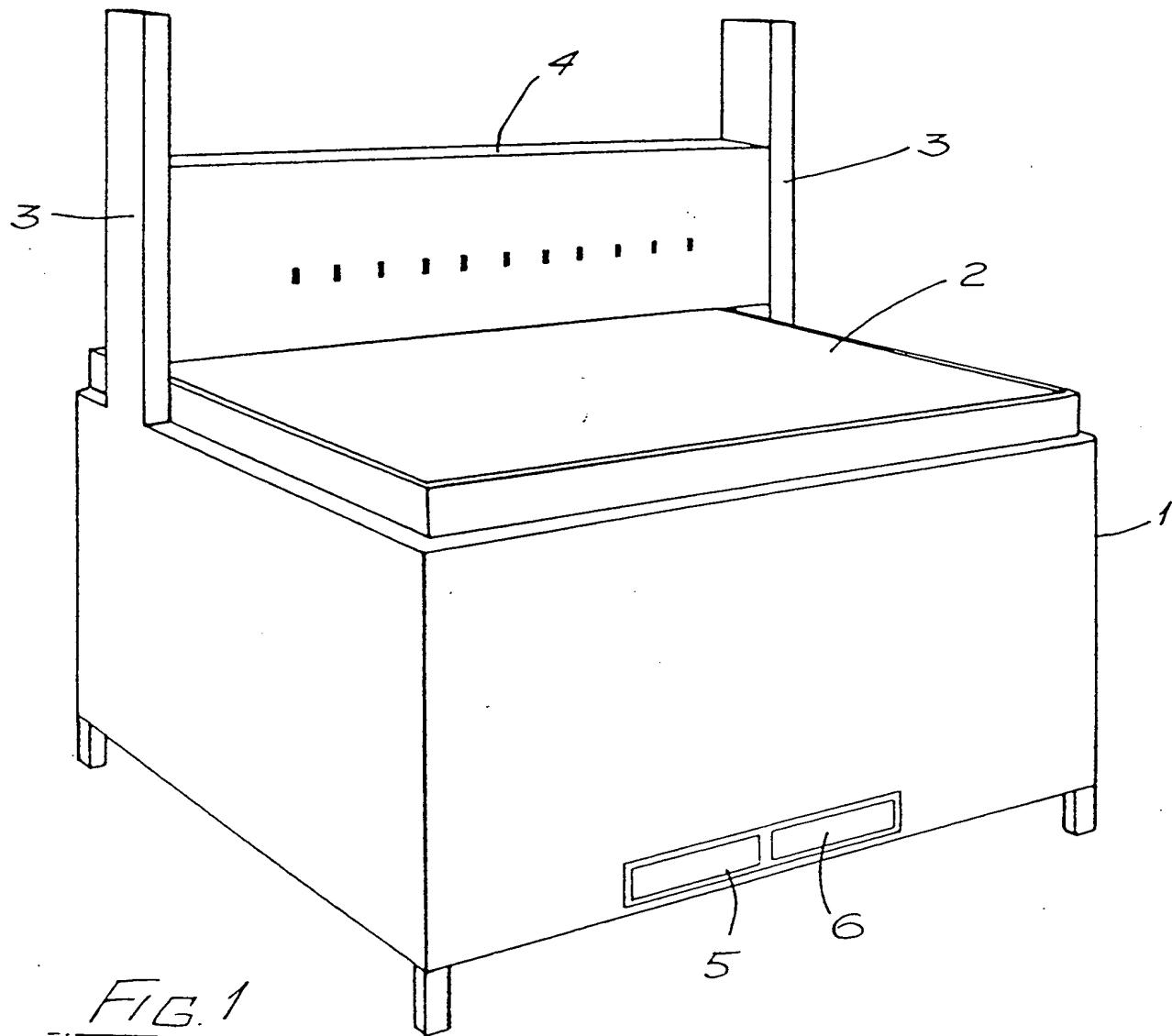
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US-A-4653369	31-03-87	None		
US-A-3320843		None		
US-A-4041815	16-08-77	US-A-	3983773	05-10-76
		CA-A-	1037376	29-08-78
		DE-A-	2611075	04-11-76
		FR-A,B	2306803	05-11-76
		GB-A-	1507101	12-04-78
		JP-A,B	51118189	16-10-76
		NL-A-	7603765	12-10-76
US-A-3580120	25-05-71	None		
US-A-4065990	03-01-78	None		
US-A-4195541	01-04-80	GB-A-	1577296	22-10-80
GB-A-1577104	15-10-80	DE-A-	2716278	26-10-78
		BE-A-	865914	31-07-78
		FR-A,B	2387103	10-11-78
		US-A-	4160396	10-07-79
US-A-3501987	24-03-70	None		
US-A-3311297		None		
FR-A-2224273	31-10-74	None		
GB-A-1369190	02-10-74	None		





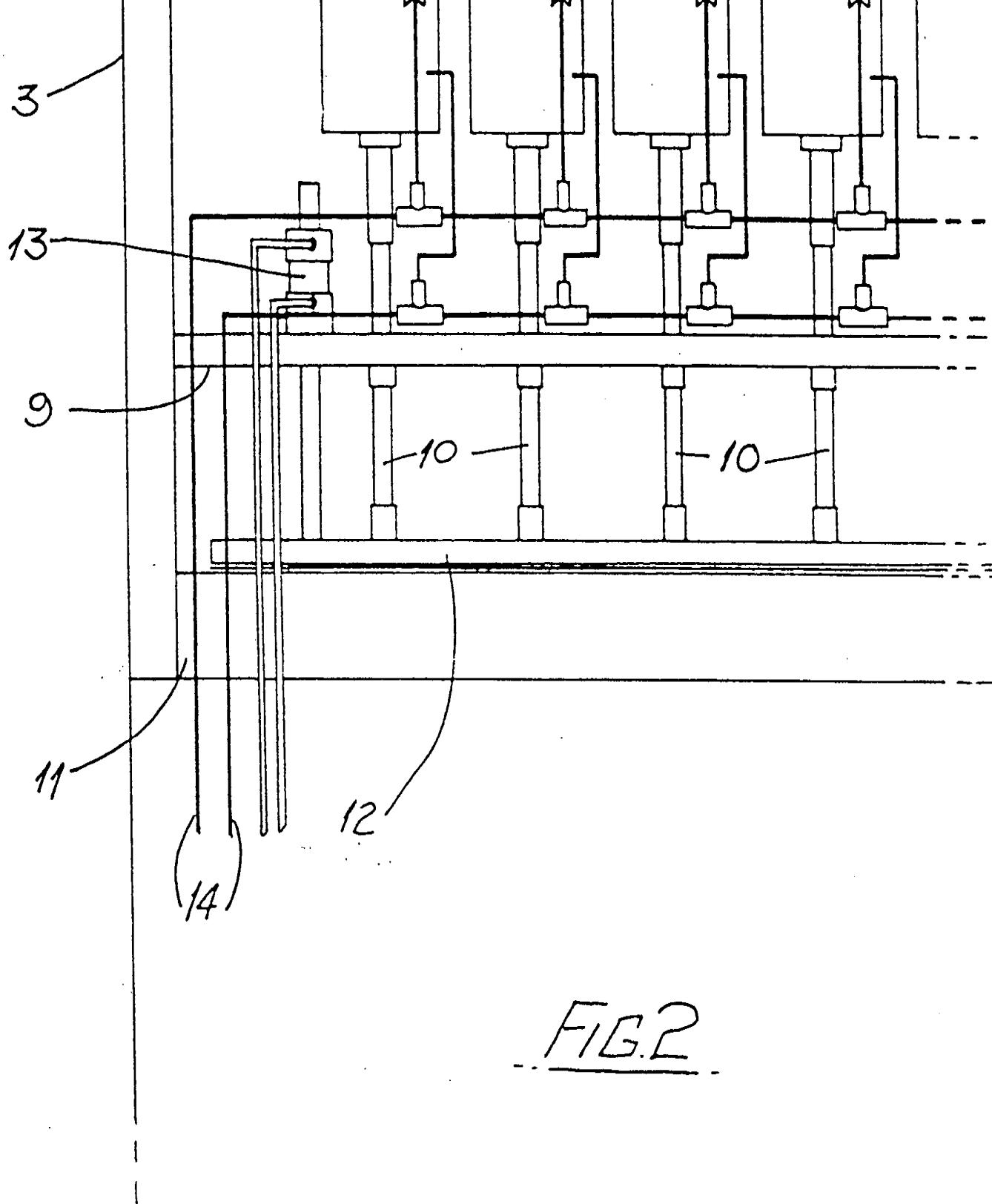


FIG. 2

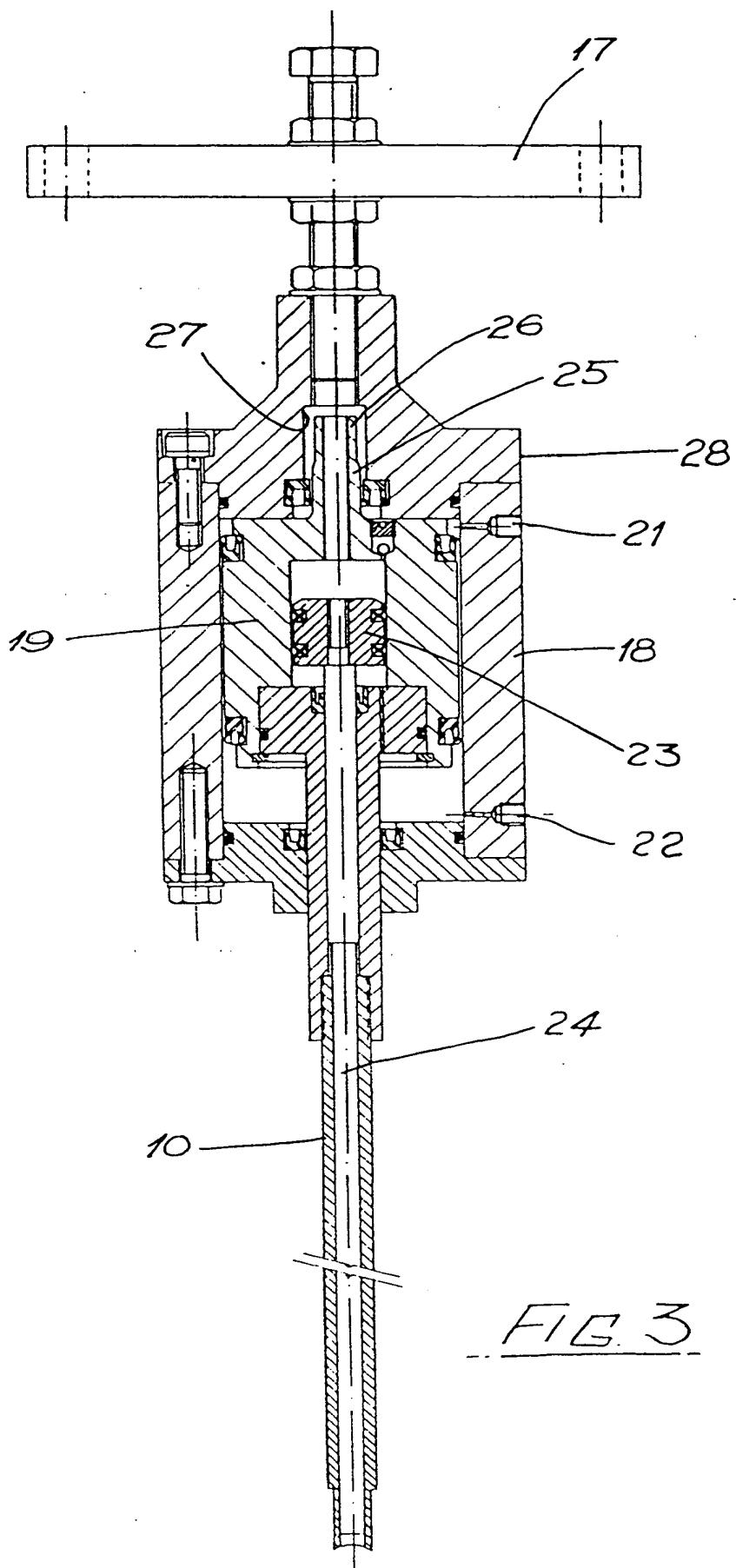


FIG. 3.

